Hardware Interface Description

Java Box Terminal
Motorola G24 Cellular + GPS Engine

Version: 02.01A
Java Box Terminal_HD_V02.01 17.JUL.2008

1. Key Features of the Java Box Terminal

Feature	Implementation
General	
Incorporates G24 module	The Motorola G24 module handles all processing for audio, signal and data within the Java Box Terminal.
Frequency bands	Quad band: GSM 850/900/1800/1900MHz
Power supply	Single supply voltage 6V to 30V
Operating temperature	-20°C to +70°C ambient temperature
Physical	Dimensions: 98mm x 82m x 30m Weight: 160g , with battery 180g
RoHS, WEEE	All hardware components are fully compliant with the EU RoHS and WEEE Directives
GSM / GPRS / EDGE features	
Data transfer	GPRS · Multislot Class 10 CSD · 2.4, 4.8, 9.6 kbps · USSD PPP-stack for GPRS data transfer
SMS	· Point-to-point MT and MO · Text and PDU mode · Storage: SIM card plus 20 SMS locations in mobile equipment · Transmission of SMS alternatively over CSD or GPRS. Preferred mode can be user defined.
Fax	Group 3; Class 1
Audio	Speech codecs: · Half rate HR · Full rate FR · Enhanced full rate EFR · Adaptive Multi Rate AMR Line echo cancellation
Software	
AT commands	AT-Hayes GSM 07.05 and 07.07
TCP/IP Stack.	TCP/IP stack Access by AT commands
Firmware update	Upgradeable via serial interface / USB

Java Midlet	Major benefits: integration into Java applications, no need for application microcontroller, extremely cost-efficient hardware and software design – ideal platform for industrial GSM applications. The memory space available for Java programs is10.0 MB flash file system and 1.8 MB RAM. Application code and data share the space in the flash file system and in RAM.
Interface	
Serial interface	· 8-wire modem interface with status and control lines, unbalanced, asynchronous · Fixed bit rates: 300 bps to 460,800 bps · Autobauding: 300 bps to 57,600 bps · Multiplex ability according to GSM 07.10 Multiplexer Protocol.
I²C	The I²C interface bus for transmission rates up to 100kbps.
Audio	Analog (Microphone amplifier ready, Speaker with 3W amplifier) 2.5mm output audio
SIM interface	Supported SIM cards: 3V
Antenna	Connected via antenna SMA connector or internal antenna
Power on/off, Reset	
Power-on	1. Automatic on when power supply turn on (IGN switch set on) 2. Switch on via On/Off push button 3. On/Off line on IO interface connector
Power-off	Normal switch-off by AT or On/Off push button
Reset	Shutdown and reset by AT command
Special features	
GPIO	16 I/O pins of the application interface are programmable as GPIO. Programming is done via AT commands. Alternatively,
ADC input	3 Analog-to-Digital Converter input for measuring external voltages. Optional measuring supply voltage to the unit.
Phonebook	SIM and phone
GPS	High sensitivity for indoor reception up to -154 dBm. Fast TTFF's at low signal levels. Hot starts less then 2 seconds. Support 12- Channel GPS. GPS NMEA 0183 output format.

2. Interface Description

2.1 Overview

Java Box Terminal provides the following connectors for power supply, interface and antennas:

1. On/Off push button.
2. SMA connector (female) for GPS / WiFi antenna.
3. GPRS Led and Power Led.
4. 9-pole (female) SUB-D plug for RS-232 serial interface.
5. SMA connector (female) for GSM antenna.
6. 24-pole GPIO 3mm Micro Mate-N-LOK connector for GPIOs, I²C, ADC, Power.
7. 4-pole 3mm Micro Mate-N-LOK connector for power supply, RTS and Ignition input.
8. 6-pole RJ11 plug (female) for audio accessory, such as a Microphone and Speaker.
9. 8-pole RJ45 plug (female) for UART2
10. USB plug type-B
11. SIM card holder.
12. 2.5mm plug (female) for audio jack, such as a Headset.

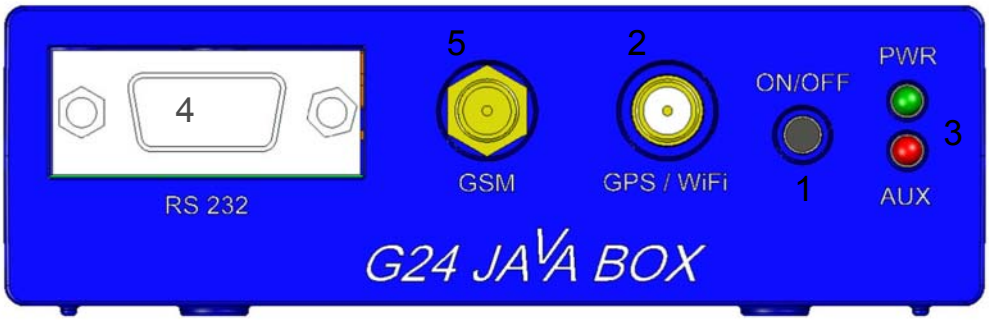


Figure 1: Java Box Terminal front view

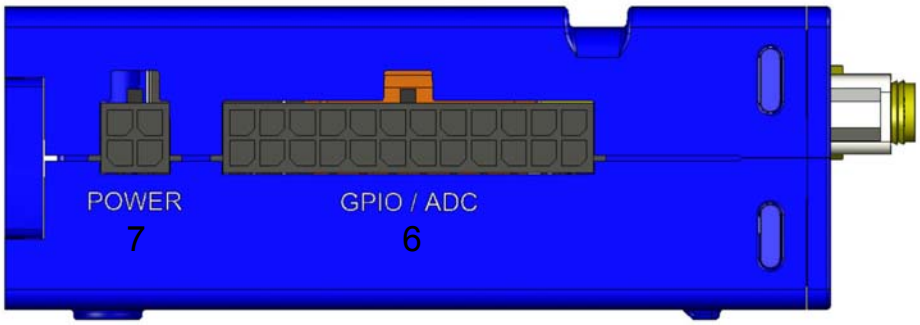


Figure 2: Java Box Terminal side A view

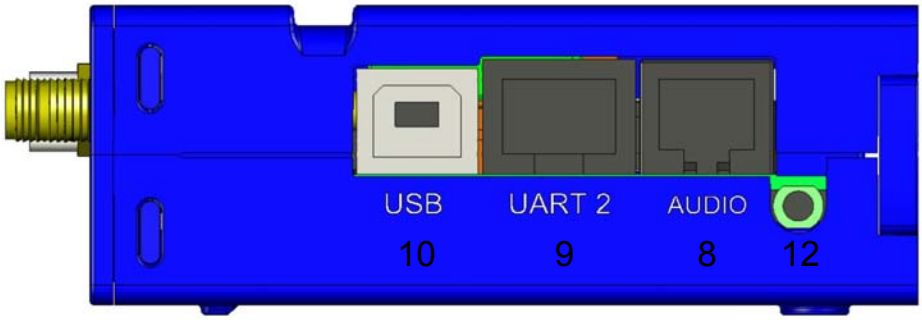


Figure 3: Java Box Terminal side B view

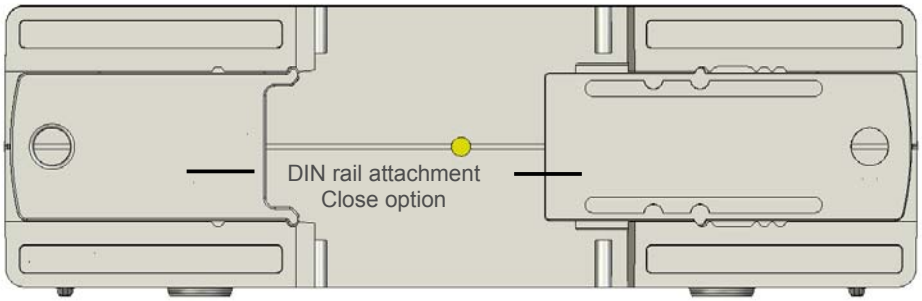


Figure 4: Java Box Terminal rear view 1- DIN rail attachment close

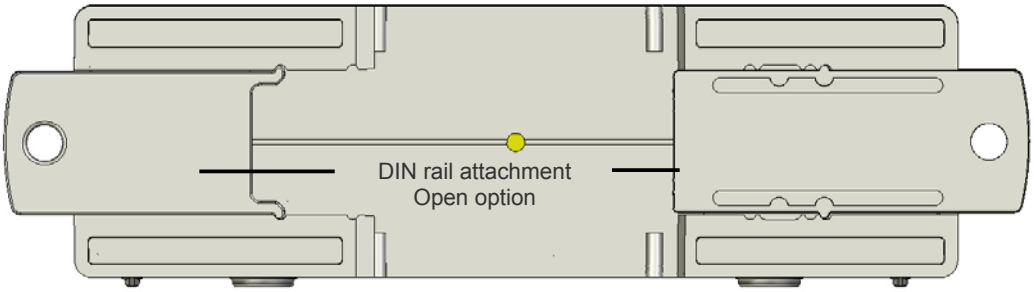


Figure 5: Java Box Terminal rear view 2 – DIN rail attachment open

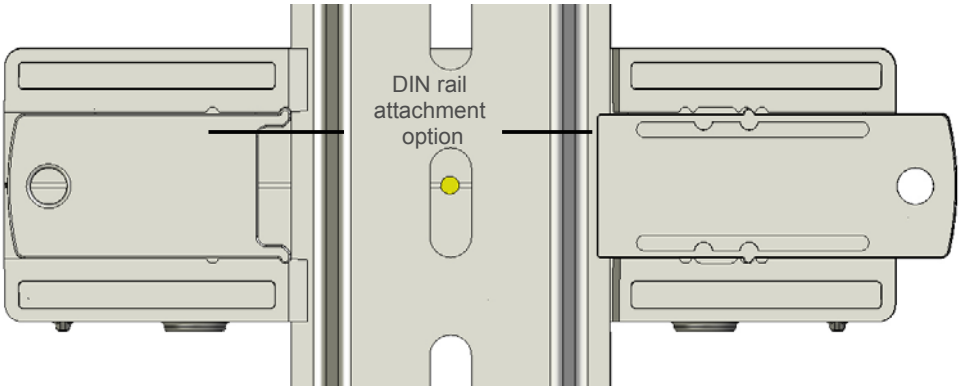


Figure 6: Java Box Terminal rear view 3 – DIN rail attachment lock on DIN rail

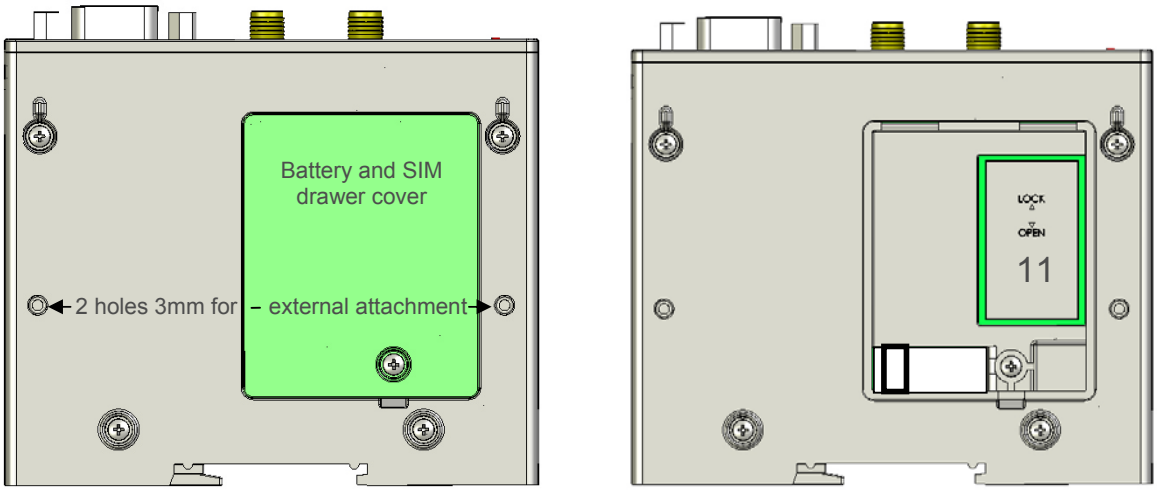


Figure 7: Java Box Terminal bottom view

2.2 Block Diagram

Figure 3 shows a block diagram of a sample configuration that incorporates a Java Box Terminal and typical accessories.

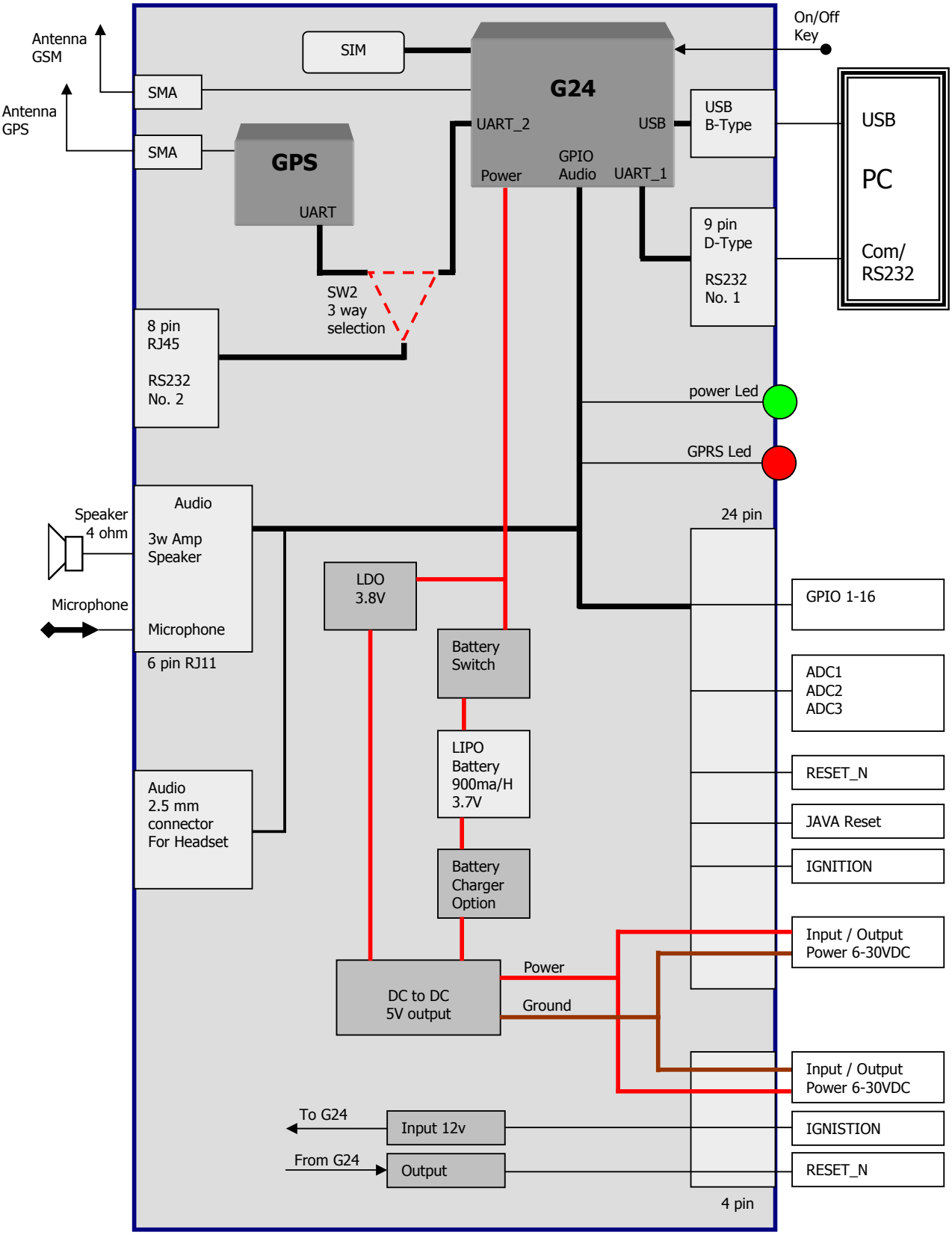


Figure 8: Block diagram Java Box

24 PIN Connector Pin #	70 PIN Connector Pin #	G24 OEM / G24-Lite	Java Box
1	28	GPIO1	GPIO1
2	30	GPIO2	GPIO2
3	32	GPIO3	GPIO3
4	34	GPIO4	GPIO4
5	36	GPIO5	GPIO5
6	38	GPIO6	GPIO6
7	40	GPIO7	GPIO7
8	42	GPIO8	GPIO8
9	41	ANT_DET	GPIO9
10	49	GPRS	GPIO10
11	26	WKUPO_N	GPIO11
12	1	GND	GND
13	23	RI_N	GPIO12
14	13	DSR_N	GPIO13
15	19	DTR_N	GPIO14
16	17	DCD_N	GPIO15
17	16	WKUPI_N	GPIO16 (JTool)
18	37	ADC1	ADC1
19	43	ADC2	ADC2
20	47	ADC3	ADC3
21	25	RESET_N	RESET_N
22	39	TXEN_N	TXEN_N
23	51	IGN	IGN
24		VIN	VIN

Table 1: Pin assignment 24 pin connector to 70 pin G24

2.3 Power Supply

The power supply of the Java Box Terminal has to be a single voltage source of POWER 6V-30V capable of providing a peak during an active transmission. The Java Box Terminal is protected from supply reversal voltage. An internal fuse ensures an electrical safety according to EN60950. This fuse is not removable. A fast acting fuse 0.8A with melting is necessary to use with the Java Box Terminal at a 24V power supply system for vehicles. The power supply must be compliant with the EN60950 guidelines.

Pin	Signal name	Direction	Use
1	POWER	In	Input Power supply range 6-30V
2	IGNITION	In	Power on console connected to input 12V
3	GND	-	Ground
4	RESET_N	Out	Output notify if modem ON

Table 2: Pin assignment of the plug for power supply and relay

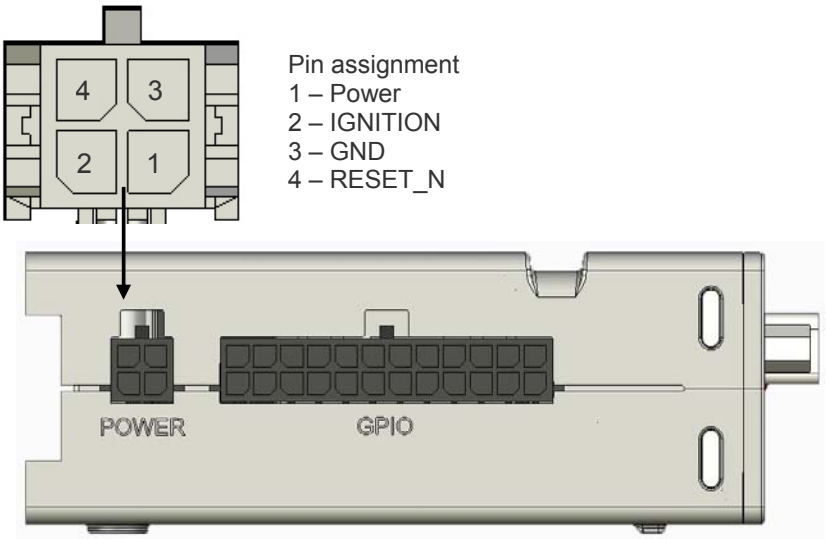


Figure 9: Male 4-pole plug for power supply.

2.3.1 Supply voltage requirements

The DC power supply must be connected to the POWER input:

· Input voltage range 6 - 30V DC
· Nominal Voltage 12V DC
· Power Supply current rating: min. 1,2A @12V
· Power Supply ripple: max. 120mV
· Input current in idle mode: 20mA @ 12V
· Input average current in communication mode: 100mA @ 12V

2.3.2 Block Diagram Battery management

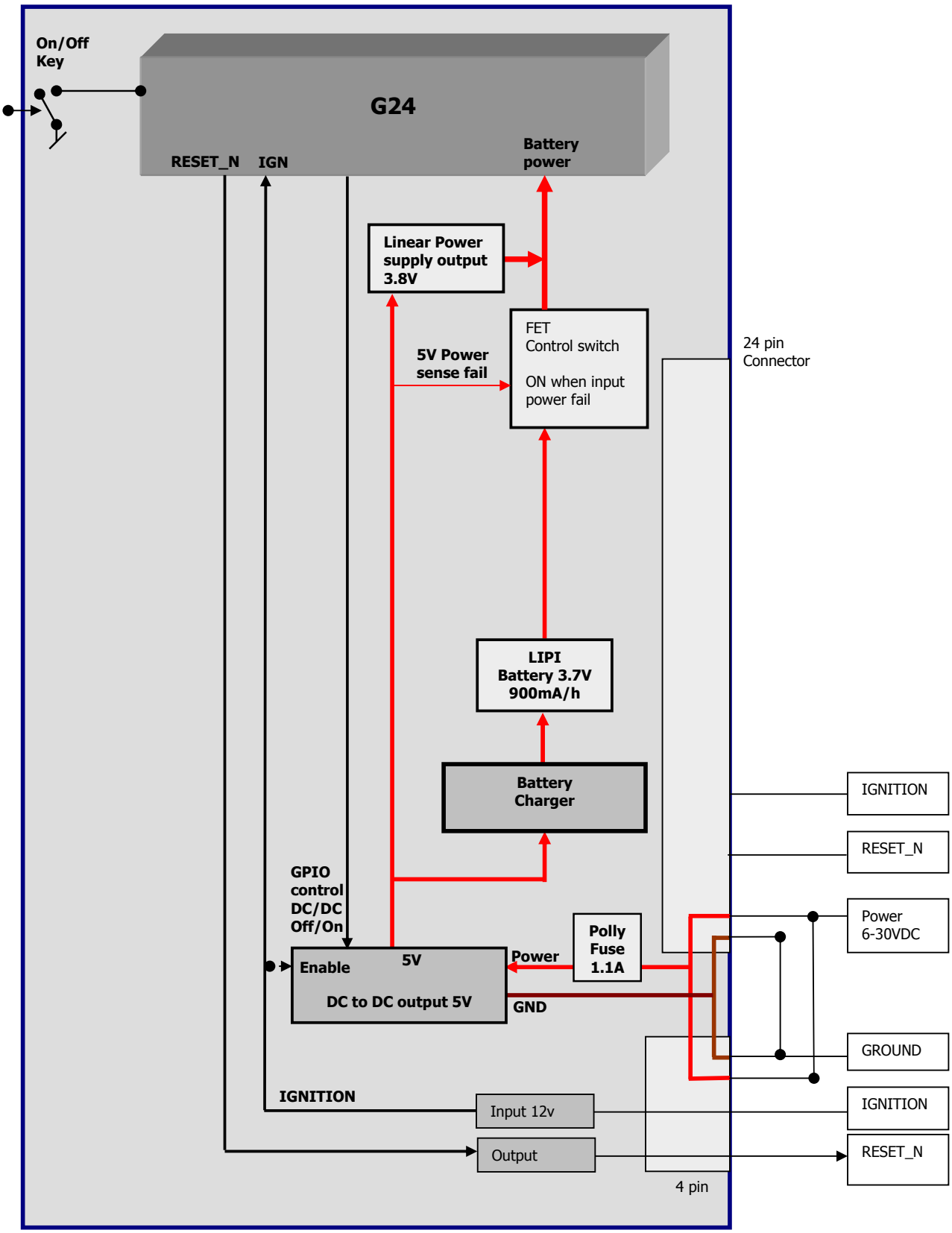


Figure 9: Block diagram Java Box energy management

2.3.3 Block Diagram Battery management flow chart explanation

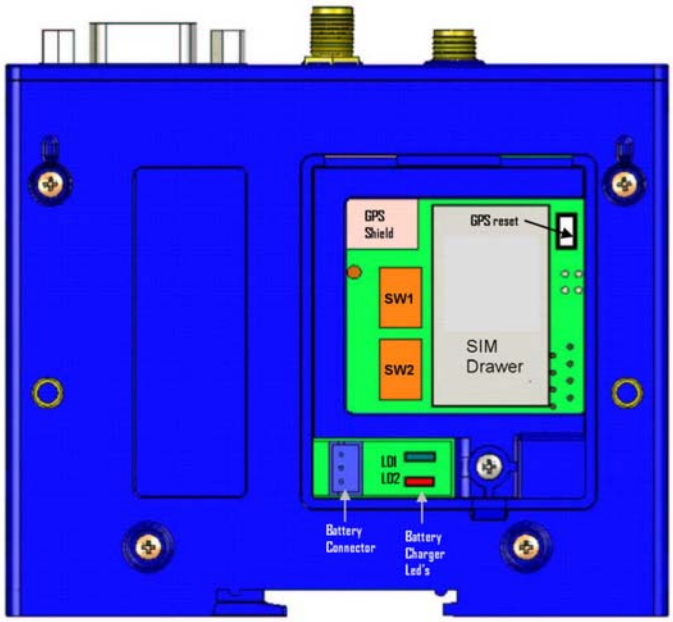
Java Box Power supply Input power 6-30 VDC, the input power pass via poly fuse and over voltage and reverse polarity protection. The DC/DC reduce the power to 5V, the 5V supply for two separate direction,

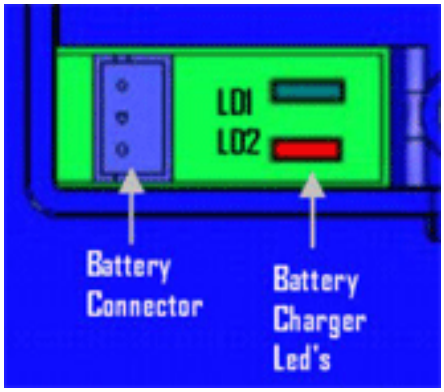
A. First direction to Linear power supply that reduce the power to 3.8V, this power supply will hold the unit power on regular base
B. Second direction to battery charger, the battery charger supply the LIPO battery the correct power management, battery selected 960ma/H max size 38*39*6.1mm with internal management card, on normal operation the battery will be charge to maximum 4.1V, the battery is use for backup and supply the power to the modem only when the main power fail or when the modem turn off the DC/DC power supply.

The Java Box automatically will switch from linear power supply to battery operation when the DC/DC power supply stops 5V output.

2.3.4 Battery charger

Battery charger on normal operation the battery will be charge to maximum 4.1V, the battery is use for backup and supply the power to the modem only when the main power fail or when the modem turn off the DC/DC power supply.





Charge condition	Description	LD1- Green	LD2- Red
Charge in progress	When the device is in Pre-Charge or fast- Charge status	ON	OFF
Charge done	When the charging current goes lower than the IENDTH	OFF	ON
Stand By mode	When the input voltage goes under VBAT - 50mV	OFF	OFF
Bad battery temperature	When the voltage on the TH pin is out of the programmable window, in accordance with the NTC	ON	ON
Battery absent	When the battery pack is removed	ON	ON
Over time	When Battery did not charge fully on the given time	ON	ON

Table 3: Status LEDs Indications

2.4 Switch on Java Box Terminal

There are several ways to turn on the Java Box Terminal:

· Switch on via On/Off push button, switch on the Java Box Terminal by pressing the On/Off key signal line must be asserted for at least 2000 ms and then released.

· Switch on via IGNITION line on the 24pin connector and the 4 pin connector.

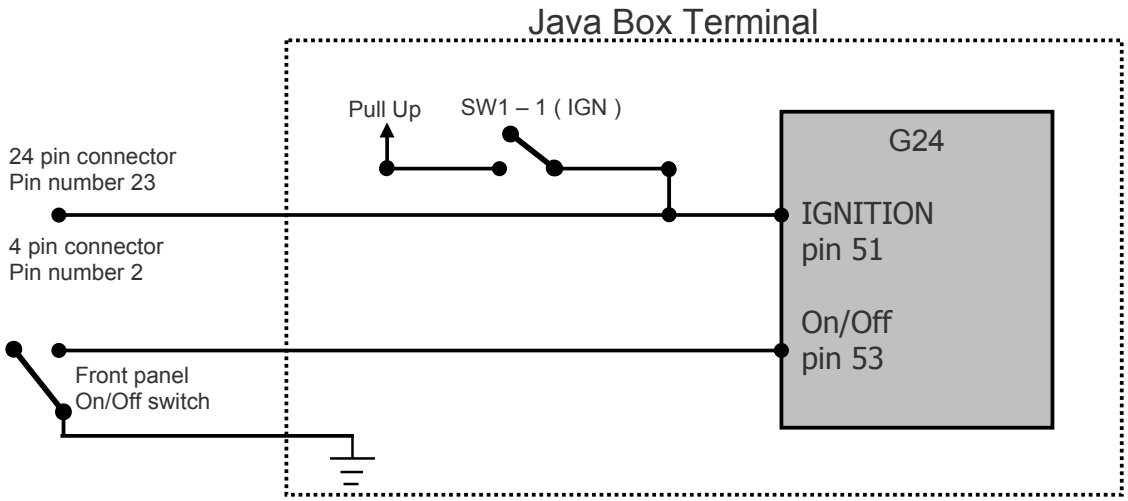


Figure 11: On/Off control

2.4.1 Reset Java Box Terminal

An easy way to reset the Java Box Terminal is entering the command AT+CFUN=0,1

2.4.2 Switch Off Java Box Terminal

There are several ways to turn off the java Box Terminal:

· Software controlled shutdown by AT command: AT+MRST
  The AT command lets Java Box Terminal log off from the network and allows the software to enter into a the secure state and safe data before disconnecting the power supply.
  The mode is referred to Power-down mode.

· Via On/Off push button.
  The Java Box Terminal will be switched off by pressing the On/Off push button or by activating the On/Off signal for >2s.

· Via IGNITION line.
  The Java Box Terminal will be switched off by IGNITION input line connected to GND.

2.4.3 Disconnecting Power Supply

Before disconnecting the power supply from the POWER pin make sure the Java Box Terminal is in a safe condition. A safe condition is waiting 2s after the "SHUTDOWN" result code has been indicated.

2.5 GPIO Interface Specification

All General Purpose input / output are connected to the related pins of the Motorola G24 module over a 100 Ohms series resistor. The following table shows the logic level specifications in the Java Box terminal interface circuits:

LEVEL	MIN	MAX
Input high level	2.0V	3.0V
Input low level	0V	0.4V
Output high level	2.5V	2.8V
Output low level	0V	0.2V

Table 4: GPIO Signal states level apply to G24 OEM

All GPIO normally HIGH with internal pull up resistor of 22k, to indicate that a LOW signal on the GPIO connect the GPIO to GND, for HIGH signal leave the GPIO open.

2.6 RS232 number 1__ Interface G24 UART1

The serial interface RS232 number 1 of the Java Box Terminal is intended for the communication between the GSM module and the host application. This RS232 interface is a data and control interface for transmitting data, AT commands and providing multiplexed channels. EMC immunity complies with the vehicular environment requirements according to EN 301 489-7.
The user interface of the Java Box Terminal is accessible from a Data Terminal Equipment DTE connected to the RS232 interface and it is managed by AT commands according to the GSM 07.07 and 07.05 specification and the supported commands are listed in the AT Commands Reference Guide.

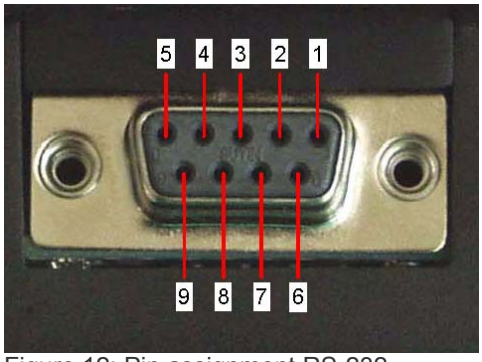


Figure 12: Pin assignment RS-232 (D-Sub 9-pole female)

Pin no.	Signal name	I/O	Function of application
1	DCD	O	Data Carrier Detected
2	RXD	O	Receive Data
3	TXD	I	Transmit Data
4	DTR	I	Data Terminal Ready
5	GND	-	Ground
6	DSR	O	Data Set Ready
7	RTS	I	Request To Send
8	CTS	O	Clear To Send
9	RING	O	Ring Indication

Table 5: D-Sub 9-pole female RS232

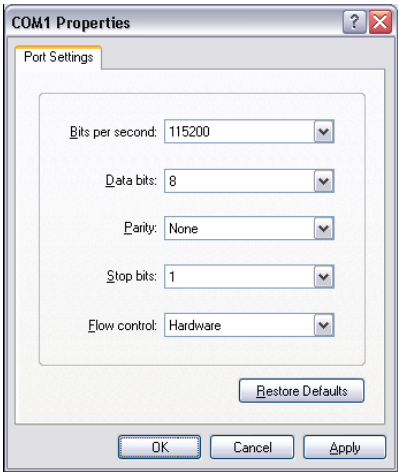
Connector type on the terminal is:

- RS-232 through D9-pin female
- Baud rate from 300 to 460,600 bit/s
- Autobauding (300 to 57,600 bit/s)
- Short circuit (to Ground) protection on all outputs.
- Input voltage range: -12V to +12V

Note: some of the RRS232 pin as dual use as GPIO, refer to table 1.

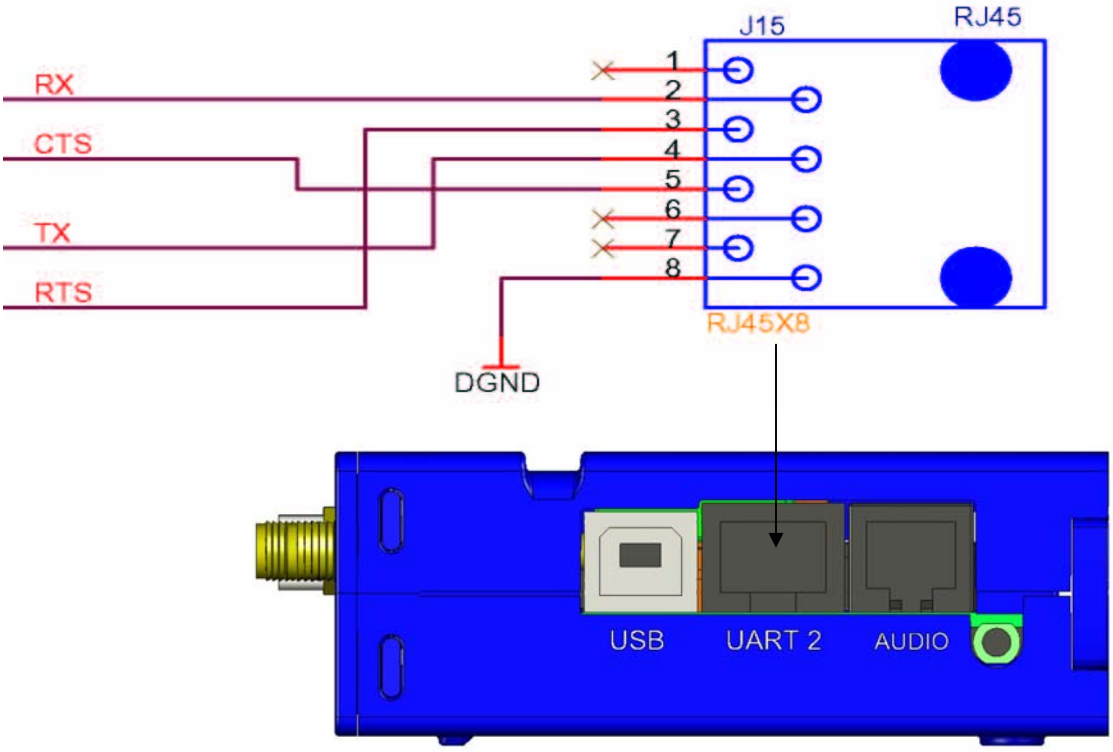
2.6.1 The PC as Data Terminal Equipment (DTE)

The software application for using the PC RS232 standard serial interface (COM-port) as Data Terminal Equipment (DTE) is usually Hyper Terminal. Connect using the COM-port to which the Java Box Terminal is connected with the following settings:



2.6.2 RS232 number 2__ Interface G24 UART2 or GPS

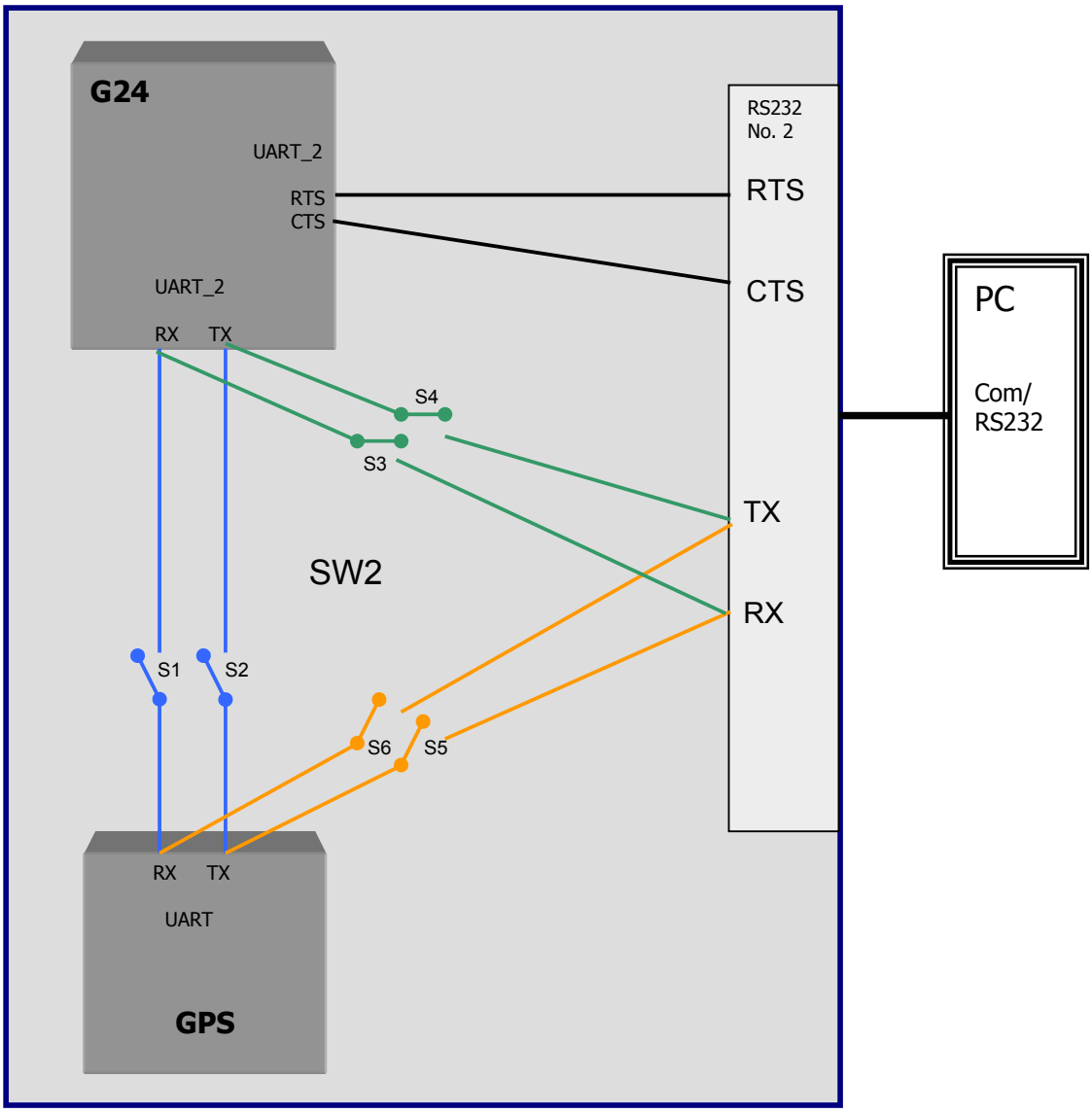
The serial interface RS232 number 2 of the Java Box Terminal is intended for the communication between the G24 GSM module UART2 and the host application. This RS-232 interface is a data and control interface for transmitting data, AT commands and providing multiplexed channels.
Alternative the serial interface RS232 number 2 of the Java Box Terminal can be switch with SW2 to be connect to the GPS.



2.6.3 SW2 switch selection

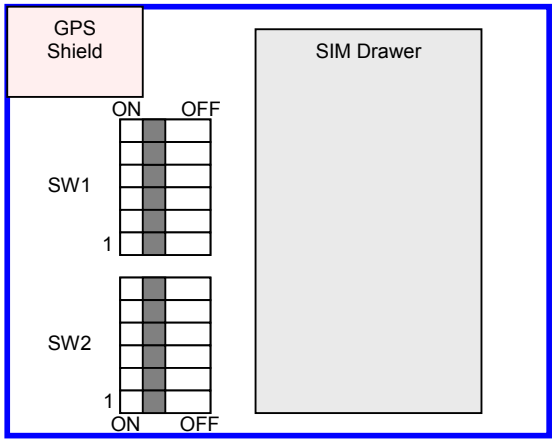
SW2 select 3 options, only 2 switches allow to be ON at the same time.

a. S1 and S2 switch ON, G24 UART2 connect to GPS UART.
b. S3 and S4 switch ON, GPS UART connect to PC RS232_2.
c. S5 and S6 switch ON, G24 UART2 connect to PC RS232_2.



SW1 - to enable switch to ON

1. IGN
2. Do Not Use
3. GPIO8
4. WKUP_I
5. GPIO1
6. DC/DC enable by IGN



2.7 Audio Interface

The audio interface provides one analog input for a microphone and one analog output for Speaker.

· The microphone input not balanced.
· The Speaker output is balanced.
· For electret microphone a supply source is implemented by the G24 Modem.
· For speaker 3W amplifier implemented output 4ohm.

Pin assignment
1 – GND
2 - Microphone-
3 - Speaker 4ohm 3w
4 - Speaker 4ohm 3w
5 - Microphone+
6 - 3.8V

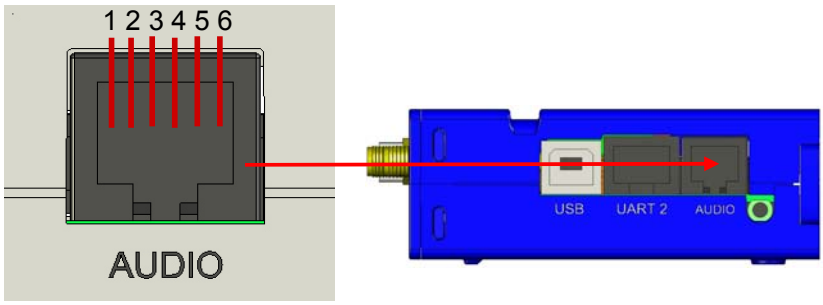


Figure 13: Audio RJ11 plug (6-pole female)

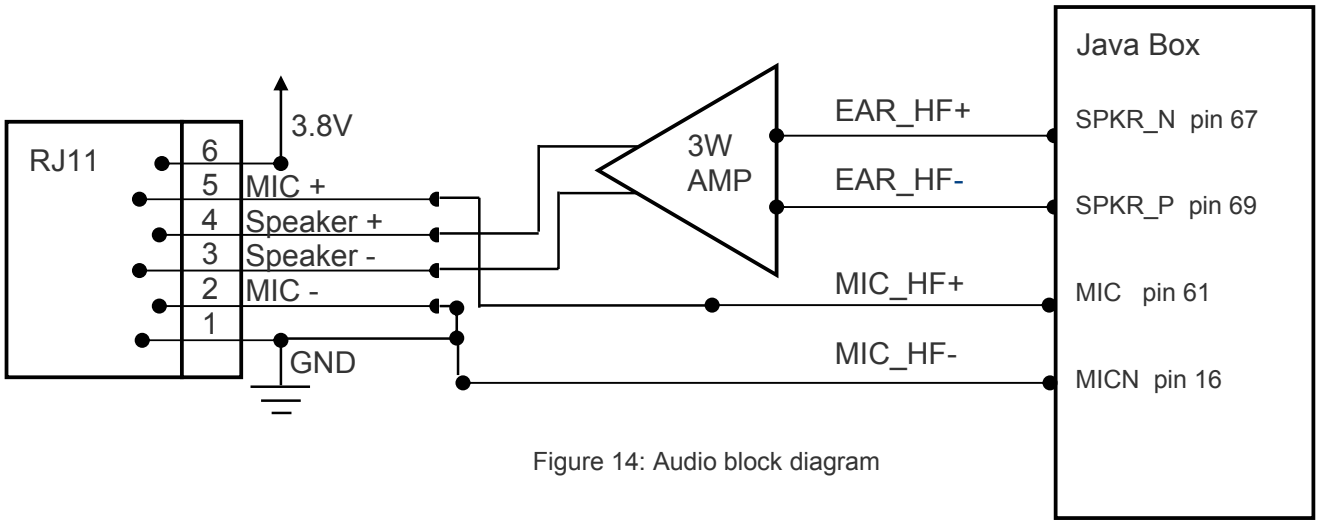


Figure 14: Audio block diagram

Sample Commands for Java Box Audio operation

1	AT+CLVL=	0 - 7	Speaker Gain
2	AT+MMICG=	0 - 31	Microphone Gain

For more Audio command refer to G24 AT command guide page 319

2.7.1 Supported Audio Modes

The audio interface can be configured by inserting the 2.5mm Jack the Audio will be connected to the Headset, when this jack is out Audio will connected to RJ11 output.

2.7 Antenna Interface

In order to send or receive data connect an external RF antenna to the SMA connector which is internally connected to the RF signal of the GSM module.
Please consider that the recommended antenna equipment has been chosen to achieve optimum RF performance when operating the Java Box Terminal.

Frequency range	Depending by frequency band(s) provided by the network operator, the customer shall use the most suitable antenna for that/those band(s)
Bandwidth	80 MHz in EGSM 900, 70 MHz if GSM 850, 170 MHz in DCS, 140 MHz PCS band
Gain	1.5dBi <= Gain < 3dBi (referenced to isotropic radiator)
Impedance	50 Ohm
Input power	> 2 W peak power
VSWR absolute max	<= 10:1
VSWR recommended	<= 2:1

Table 6: Antenna speciation

2.8.1 Operating Frequency

The operating frequencies in GSM, DCS, PCS modes are conform to the GSM specifications.

Mode	Freq. TX (MHz)	Freq. RX (MHz)	Channels (ARFC)	TX - RX offset
E-GSM-900	890.0 - 914.8	935.0 - 959.8	0 – 124	45 MHz
	880.2 - 889.8	925.2 - 934.8	975 - 1023	45 MHz
GSM-850	824.2 – 848.8	969.2 – 893.8	128 - 251	45 MHz
DCS-1800	1710.2 - 1784.8	1805.2 - 1879.8	512 – 885	95 MHz
PCS-1900	1850.2 - 1909.8	1930.2 - 1989.8	512 - 810	80 MHz

Table 7: Operating frequencies

Transmitter output power

GSM–850 / 900
The Java Box modem in GSM–850/900 operating mode are class 4 in accordance with the specification which determine the nominal 2W peak RF power (+33dBm) on 50 Ohm.

DCS–1800 / PCS-1900
The Java Box modem in DCS–1800/PCS-1900 operating mode are of class 1 in accordance with the specifications which determine the nominal 1W peak RF power (+30dBm) on 50 Ohm.

Reference sensitivity

GSM–850 / 900
The sensitivity of the Java Box modem according to the specifications for the class 4 GSM–850/900 portable terminals is –107dBm typical in normal operating conditions.

DCS–1800 / PCS-1900
The sensitivity of the Java Box modem according to the specifications for the class 1 portable terminals DCS-1800 / PCS-1900 is –106 dBm typical in normal operating conditions.

2.9 SIM Interface

The SIM interface is intended for 3V SIM cards. The card holder is a five wire interface according to GSM 11.11. A sixth pin has been added to detect whether or not the SIM card drawer is inserted. Removing and inserting the SIM card during operation requires the software to be reinitialized. Therefore, after reinserting the SIM card it is necessary to restart Java Box Terminal.

2.10 IO Interface

The following interfaces and functions are provided via the IO interface connector.

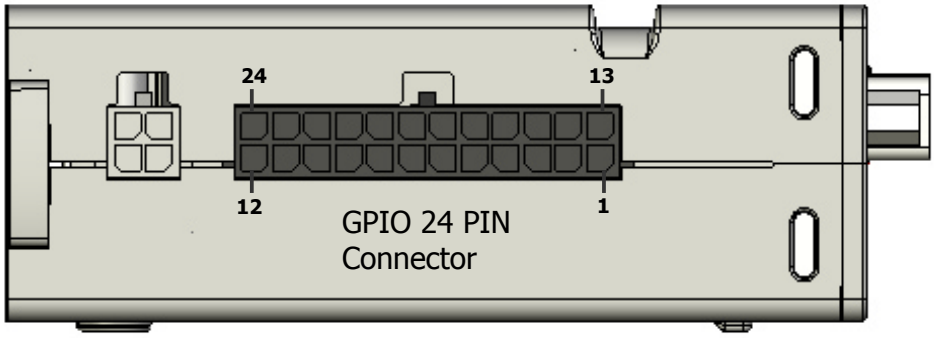


Figure 15: GPIO interface connector 24 pin

Pin	Signal name	I/O	Description
1	GPIO1	I/O	GPIO input or output conferrable
2	GPIO2	I/O	GPIO input or output conferrable
3	GPIO3	I/O	GPIO input or output conferrable
4	GPIO4	I/O	GPIO input or output conferrable
5	GPIO5	I/O	GPIO input or output conferrable
6	GPIO6	I/O	GPIO input or output conferrable
7	GPIO7	I/O	GPIO input or output conferrable
8	GPIO8	I/O	GPIO input or output conferrable
9	GPIO9	I/O	GPIO input or output conferrable
10	GPIO10	I/O	GPIO input or output conferrable
11	GPIO11	I/O	GPIO input or output conferrable
12	GND		
13	GPIO12	I/O	GPIO input or output conferrable
14	GPIO13	I/O	GPIO input or output conferrable
15	GPIO14	I/O	GPIO input or output conferrable
16	GPIO15	I/O	GPIO input or output conferrable
17	GPIO16	I/O	GPIO input or output conferrable
18	ADC1	I	analog input 1
19	ADC2	I	analog input 2
20	ADC3	I	analog input 3
21	TXEN_N	O	Modem G24 on or off status
22	JAVA_RESET	I	Reset Java MIDLET
23	IGNITION	I	Start Modem
24	VIN	I	Input Power Supply

Table 8: Assignment of the IO interface connector

2.11 Status LED

Green LED displays the network status of the Java Box Terminal.

Green LED status	Device Status
permanently on	Unit is active
permanently off	device off

Table 9: Green LED Status

Red LED displays the operating status of the GPRS in the Java Box Terminal, option internal resistor for GPIO8 indication.

3. GPS

3.1 GPS Antenna Requirements

The GPS module is not provided with an internal LNA amplifier. The use of an active antenna is important to achieve a good performance. The module is provided of an Antenna supply circuit.
As suggested on the Product Description the external active antenna for a GPS device shall fulfill the following requirements:

ANTENNA REQUIREMENTS	
Frequency range	1575.42 MHz (GPS L1)
Bandwidth	+- 1.023 MHz
Gain	1.5 dBi < Gain < 4.5 dBi
Impedance	50 ohm
Amplification	Typical 25dB (max 27dB)
Supply voltage	Must accept from 3 to 5 V DC
Current consumption	Typical 20 mA (40 mA max)

Table 10: GPS Antenna requirements

4. Mechanical Characteristics

Weight	160g
Dimensions (max) L x W x H	98 mm x 82mm x 30mm
Temperature range	-20°C to +70°C ambient temperature
Protection class	IP40 Avoid exposing JAVA BOX Terminal to liquid or moisture
Mechanical vibrations Amplitude	7.5mm at 5-200Hz sinus
Air humidity	5% - 85%
Class of flammability	UL94 HB
Casing material	PC/ABS Cycoloy 1200 HF

Table 11: Mechanical characteristics

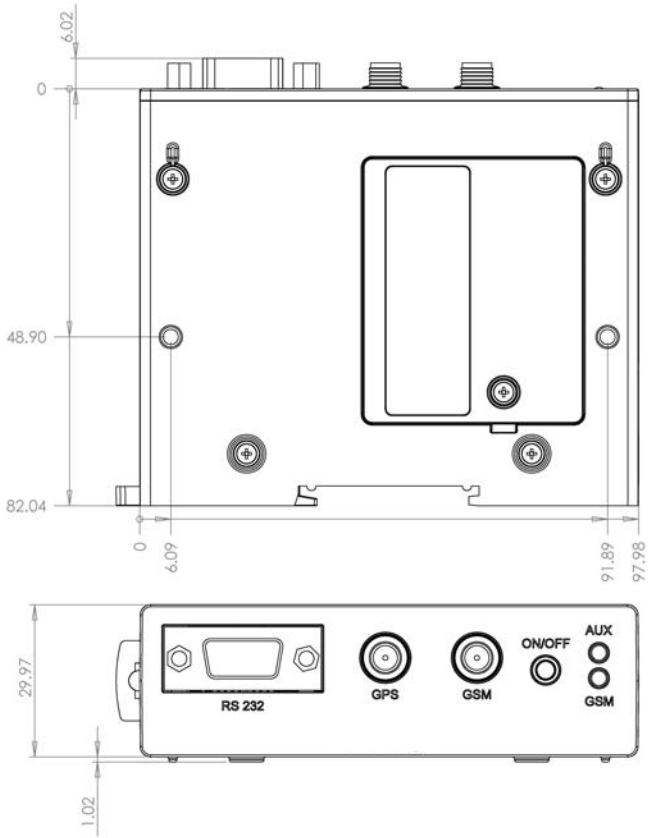


Figure 19: Mechanical measurements

5. ACCSESSORIES

5.1 24 pins Interface Connector

This chapter provides specifications for the 24-pin IO interface connector which serves the GPIO interfaces of the Terminal. The type of the receptacle assembled on the JAVA BOX Terminal is 24 pin Micro Mate-N-LOK 3mm from MOLEX. Mating headers can be chosen from the MOLEX Micro Mate-N-LOK Series. For latest product information http://www.molex.com

5.2 Power Supply

This chapter provides specifications for the power supply which serves the Terminal. The power supply we recommended is 12V 1.2A part number JB12V1.2A. The type of the receptacle assembled on the JAVA BOX Terminal is 4 pin Micro Mate-N-LOK 3mm from MOLEX. Mating headers can be chosen from the MOLEX Micro Mate-N-LOK Series. For latest product information http://www.molex.com

5.3 Battery

This chapter provides specifications for the Battery which serves the Terminal. The LIPO battery we recommended is 3.7V 900mA/h part number JBbattery900 mechanical size 38*39*6.1mm. The type of the receptacle assembled on the JAVA BOX Terminal is 3 pin Micro Mate-N-LOK 2.0mm from MOLEX. Mating headers can be chosen from the MOLEX Micro Mate-N-LOK Series. For latest product information http://www.molex.com

5.4 Power cable

This chapter provides specifications for the power cable which serves the Terminal. The power supply we recommended is 30V 1.2A part number JBPowerCable. The type of the receptacle assembled on the JAVA BOX Terminal is 4 pin Micro Mate-N-LOK 3mm from MOLEX. Mating headers can be chosen from the MOLEX Micro Mate-N-LOK Series. For latest product information http://www.molex.com

5.5 GSM antenna

This chapter provides specifications for the GSM antennas which serves the Terminal.
We recommended 4 types of GSM antennas with SMA connector:
900/1800Mhz 2.5dBm 3 meter cable part number JBantenna2.5db3M9001800.
850/1900Mhz 2.5dBm 3 meter cable part number JBantenna2.5db3M8501900.
900/1800/1900Mhz 1dBm 5 cm 90 degree SMA part number JBantenna1db5m90018001900SMA.

5.6 GPS antenna

This chapter provides specifications for the GPS antennas which serves the Terminal.
We recommended 2 types of GPS antennas with SMA connector:
1500Mhz 5 meter cable part number GBantennaGPS5m.

5.7 RS232 cable UART 1

This chapter provides specifications for the RS232 Cable UART 1 which serves the Terminal.
We recommended Cable 9 pin D-Type male to female
RS232_1 cable 2 meter cable part number GBrs232Dytpe2m

5.7 RS232 cable UART 2

This chapter provides specifications for the RS232 Cable UART 2 which serves the Terminal.
We recommended Cable RJ45 male to female 9 pin D-Type
RS232_2 cable 1 meter cable part number GBrs232RJ451m

5.7 RJ11 Audio cable

This chapter provides specifications for the AUDIO Cable RJ11 which serves the Terminal.
We recommended Cable RJ11 male to male 6 pin
AUDIO Cable RJ11 20cm meter cable part number GBaudioRJ11m

5.7 USB cable

This chapter provides specifications for the USB Cable which serves the Terminal.
We recommended Cable USB male USB type B to male USB type A
USB Cable 1 meter cable part number GBUSB1m

6. SAFETY RECOMMANDATIONS

READ CAREFULLY

Be sure the use of this product is allowed in the country and in the environment required. The use of this product may be dangerous and has to be avoided in the following areas:

Where it can interfere with other electronic devices in environments such as hospitals, airports, aircrafts, etc. Where there is risk of explosion such as gasoline stations, oil refineries, etc

It is responsibility of the user to enforce the country regulation and the specific environment regulation.

Do not disassemble the product; any mark of tampering will compromise the warranty validity. We recommend following the instructions of the hardware user guides for a correct wiring of the product. The product has to be supplied with a stabilized voltage source and the wiring has to be conforming to the security and fire prevention regulations. The product has to be handled with care, avoiding any contact with the pins because electrostatic discharges may damage the product itself. Same cautions have to be taken for the SIM, checking carefully the instruction for its use. Do not insert or remove the SIM when the product is in power saving mode. The system integrator is responsible of the functioning of the final product; therefore, care has to be taken to the external components of the module, as well as of any project or installation issue, because the risk of disturbing the GSM network or external devices or having impact on the security. Should there be any doubt, please refer to the technical documentation and the regulations in force. Every module has to be equipped with a proper antenna with specific characteristics. The antenna has to be installed with care in order to avoid any interference with other electronic devices and has to guarantee a minimum distance from the body (20 cm). In case of this requirement cannot be satisfied, the system integrator has to assess the final product against the SAR regulation. The European Community provides some Directives for the electronic equipments introduced on the market. All the relevant information's are available on the European Community website: http://europa.eu.int/comm/enterprise/rtte/dir99-5.htm

The text of the Directive 99/05 regarding telecommunication equipments is available, while the applicable Directives (Low Voltage and EMC) are available at:
http://europa.eu.int/comm/enterprise/electr_equipment/index_en.htm

7. JAVA BOX GPS Options

This chapter provides options that can be use on the JAVA BOX GPS.

7.1 Battery Source Power

7.1.1 Battery Power

Single 3.7V LIPO cell battery type is use for supplying the power to the JAVA BOX The battery capacity 900mAh.

7.1.2 Battery Charge control Circuitry

The charging process for LIPO Battery divided into 4 phases:

· Qualification and trickle charging

· Fast charge 1 - constant current

· Final charge - constant voltage or pulsed charging

· Maintenance charge

The qualification process down by special internal chip, this chip is battery charger voltage regulator. moreover all these operations should start only if battery temperature is inside a charging range, usually 5°C - 45°C. The JAVA BOX measures the temperature of its internal component, in order to satisfy this last requirement, it's not exactly the same as the battery temperature but in common application the two temperature should not differ too much and the charging temperature range should be guaranteed.

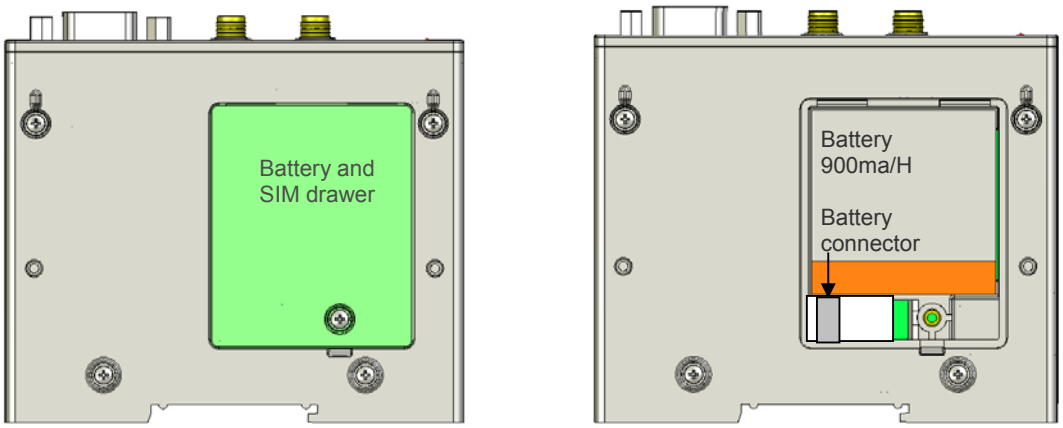


Figure 20: JAVA BOX Terminal bottom view LIPO Battery location